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AN INDEX OF CHANGES IN EXTRACTIVE INDUSTRIES.

BY WILLIAM E. LEONARD, *School of Economics, University of Texas.*

The following pages deal primarily with changes in production during the past thirty years of our industrial history—that is, from 1880 to 1909. For the purposes of this paper it is assumed, in the first place, that the gross output of our farms, forests, and mines, as expressed in bushels, tons, etc., may be taken as a fairly correct index of our capacity to produce utilities. In the aggregate volume of these products is found the basis for manufacture and commerce. And in saying this there is no disposition to relegate these industries to any less important position in our industrial life, but simply to regard them as later, or secondary stages, in the process of production.

Moreover, it is believed that production expressed in the terms of quantities gives a more nearly correct view than if expressed in value. This is due, of course, to the familiar fact that our standard of value itself is constantly undergoing change. This is especially true in the past thirty years, during which there has been an undoubted expansion and shrinkage in value of the dollar. For this reason any comparison based on values would prove false. Then, too, quantity is directly connected with the standard of life in a way that value cannot be: high values may mean a low standard of living, but large quantities in production must ultimately mean the satisfaction of more wants.

But more important, in the long run, than mere volume of production, are the tendencies which, from period to period, assert themselves. For instance, what sources of production tend to shrivel and dry up? What sources tend, not merely to maintain themselves, but to steadily increase? What new sources of production come into existence? All such changes are fundamental in the economic life of a people.

Important as the long-time movements are, they form, nevertheless, but one factor in the problem—the supply factor. The second factor is population and this represents the demand factor. It is futile to study the one apart from the other. They are necessarily interrelated and mutually dependent upon each other. Does population increase more rapidly than production? Sooner or later prices must rise, capital funds are reduced, and the standard of life goes down. On the other hand, does production outrun population in rapidity of increase? In this case a surplus will soon appear, one part of which will go, under normal conditions, to increase the funds out of which capital is drawn, and the remaining part to increase the standard of well-being.

It is impossible, of course, to bring into array all production. However, as early as 1880, we have a fairly correct record of the annual output of the great staples of soil and mine. All together some twenty-five of these staples are taken account of in this paper. These are so important that they represent by far the greater part of the whole field of production. It is doubtful if the production of other materials would exert any modifying influence upon general movements. Farm products will include corn, wheat, cotton, potatoes, sugar, tobacco, and a half-dozen less important commodities. All farm animals are included, all forest products, and all the chief minerals, except gold and silver.

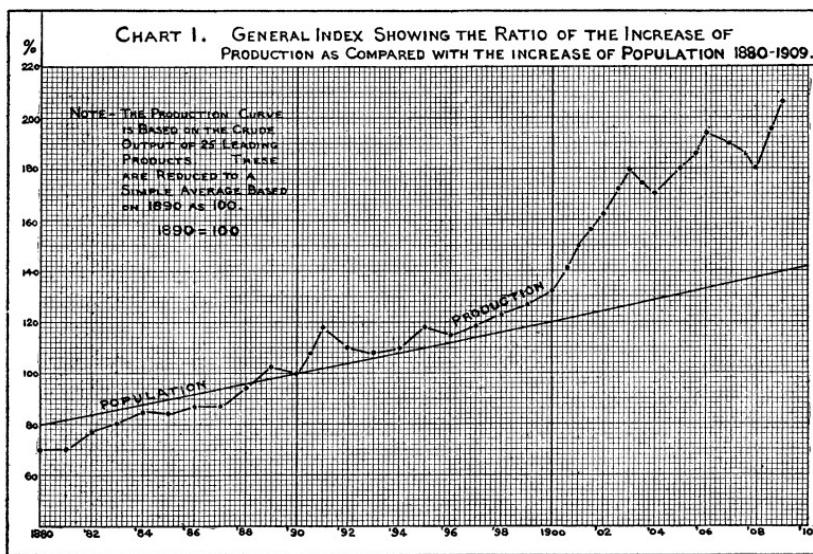
The output of each product, for each year, is reduced to a simple index with 1890 as 100. This year is made the base year for all products as well as for population. This gives a perfectly uniform basis for comparison. This year, 1890, is chosen because it is, perhaps, the most normal year of the whole period. An unweighted average is used for two reasons: it is perfectly simple and requires no explanation, and in the second place this average is conservative, rather tending to minimize tendencies and to give comparative results entirely within the truth.

The one third of a century covered by this study is one of unusual interest because of the variety and nature of its economic movements. The earlier years go back to a time when competition was the law of trade; to the days when

small scale industry was the rule, and when private initiative was practically unrestrained by public interference. The latter years have brought big business and monopoly as the dominant form of industry, while legislative scrutiny and legal interference represent a new public attitude towards industry. These changes record the passage to a new economic order: That they have affected the productive powers of the nation may be accepted without question.

GENERAL INDEX FOR POPULATION AND PRODUCTION.

First, in order, is a comparison between the index for population and that of production as a whole (Chart 1). The



curve for population, of course, shows so uniform a rate of increase that for practical purposes there results a nearly straight line. As for the combined sources of production, a quite different story is told.

1. Taking the date 1896, for instance, and comparing the years before with those after it, there appear many ups-and-downs in the first, but very few in the later period.

2. During the whole 30 years production has increased more rapidly than population except for a few periods of short duration. The drops extend over from one to two years.

The rises extend over longer periods, ranging from two to seven years. Under these circumstances the standard of living is affected adversely only for brief intervals, the tendency being steadily upward.

3. The rapid upward tendency is especially marked since 1896. Roughly, but approximately, this increase is shown as follows:

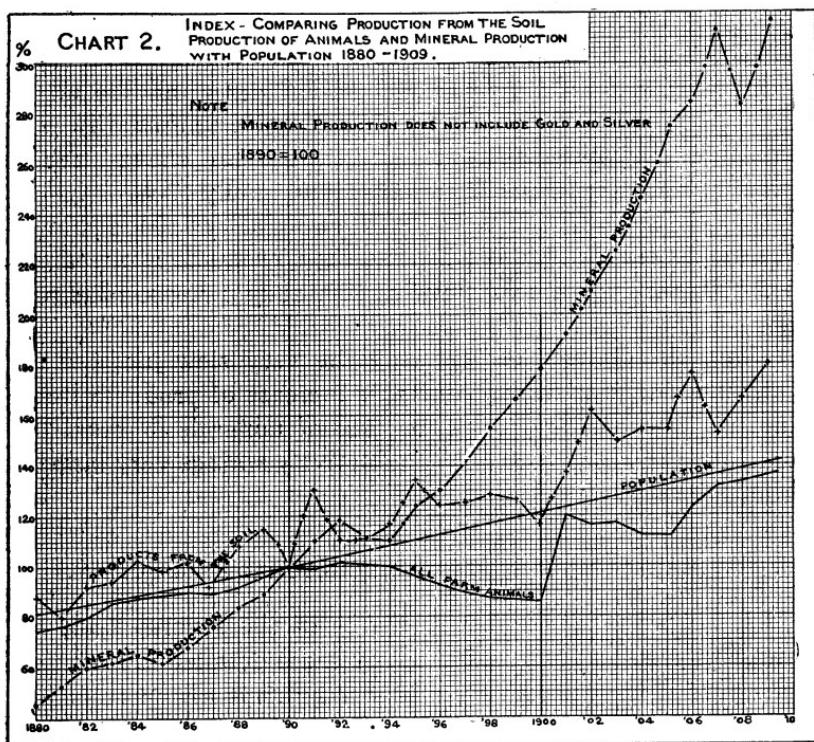
	1880 to 1896 (16 years) 1890=100.	1896 to 1909 (14 years) 1890=100.
Index for increase of population.....	32.3	29.2
Index for increase of production.....	39.3	104.1

During this period the index for production stands at 104, as compared with 39, for the first. By assuming a relatively high standard of living for the first period we can certainly conclude that, for the later years, we are fortunate indeed.

PRODUCTION IN THE SEVERAL FIELDS OF EXTRACTIVE INDUSTRY.

So much for the general movement of the two factors, population and production. A second question, whether all industries have contributed equally to the very favorable increase, is answered in Chart 2. The composite production curve of Chart 1 is separated into its factors, clearly revealing the part each industry has played in the whole field of production. Extremes of great importance appear. On the one hand, farm animal production has increased scarcely as fast as population, while mineral production has moved forward at a phenomenal rate. In these movements several points are to be noted.

1. The characteristic saw-tooth movement of agricultural production throughout the whole period. This is due, of



course, to seasonal and price fluctuations coupled with the fact that agriculture, being a competitive industry, there is little or no regulation of the output. Hence one extreme follows another in yearly cycles. The last ten years show a decided tendency to increase, but with great yearly fluctuations.

2. The curve for farm animal production is wholly different from any other line of production. Roughly, there are three ten-year periods, moving in cycular form. The first ten years show a slow, but steady, increase; the second ten years, a steady decline; the last ten years, showing great irregularities: first, phenomenal rise, a decline, and a final rise at the close. For the whole period farm animal production corresponds very closely, except for its irregularities, to the line representing population.

3. The curve for mineral production is most interesting. There are several points to be noted:

(a) Except for the transitional period in the middle nineties the movement is very regular and quite uniformly upward. Only three downward movements are shown: 1885, which is insignificant; 1893 and 1894, and finally 1908.

(b) The sharpness of the upward swing after 1894 is shown in the fact that from 1880 to 1894 their production increased 64.1 per cent., while, from 1894 to 1909 they increased 208 per cent.

From the above facts showing the very slow increase of animal production, a much greater increase of products from the soil, and a phenomenal increase of minerals it must be concluded that our increased productivity springs very largely from minerals.

CHANGING CHARACTER OF AGRICULTURAL PRODUCTION.

Thus far the general movements of the several fields of production have been followed. A more detailed analysis of each field is now attempted. In doing this it will be interesting to compare the first years of the period with the last. However, to guard against errors due to exceptional years, (as the first and last might be) an average has been taken of the years 1880, 1881, and 1882 for comparison with an average of the last three—1907, 1908, 1909. It is believed this method will avoid any error due to exceptional years, either good or bad.

Applying this method to agricultural products, we find, that each figures very differently as to output. Roughly there may be distinguished three groups. In the first group will be found wheat, wool, and swine and, at the present time, cattle; in the second, cotton and horses.

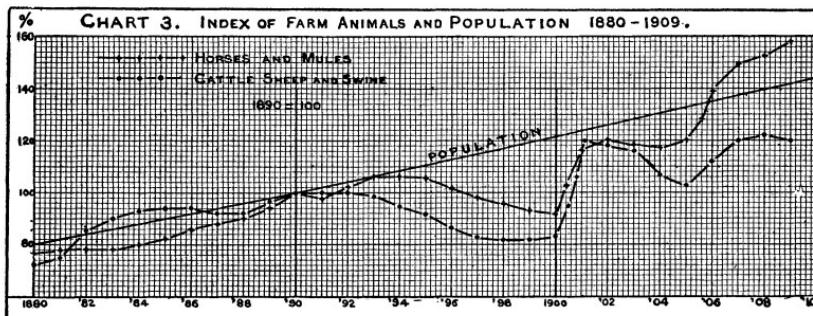
Groups of Products.		3-year average (1880, '81, '82) 1890=100.	3-year average (1907, '08, '09) 1890=100.	Increase.
	Index for Population.	80.	141.5.	61.5.
I. Farm products which have not increased as rapidly as population.	Index for Production: Wheat, Rye, Buckwheat, Wool, Swine,	114.9 97.5 94.0 89.9 73.9	169.6 123.5 127.3 113.2 106.6	54.7 26.0 33.3 23.2 32.7
II. Farm products whose increase is relatively the same as the increase of population.	Horses, Cotton, Tobacco,	77.7 72.8 80.6	141.3 134.6 141.6	63.6 61.8 61.0
III. Farm products showing a relatively large increase.	*Cattle, Corn, Oats, Mules, Potatoes, Barley, Sugar, Rice,	64.5 101.2 84.0 74.7 119.6 66.9 70.3 76.6	135.6 179.8 163.5 167.7 214.3 243.0 239.0 439.3	71.1 78.6 79.5 93.0 94.7 176.1 168.7 362.7

*Recent years have seen a remarkable decline in the production of cattle, as is shown by the following figures:

1909,	71.1 millions, with index at 134.
1910,	69.0 " " 130.
1911,	60.5 " " 114.
1912,	57.9 " " 109.

The 3-year average for 1880, '81, and '82 of 64.5, when compared with the index at 109 for 1912 shows an increase of only about 45 per cent. thus putting cattle in the first group, instead of the third, group as shown above.

A further analysis of farm animals is made by throwing them into two classes, those desired for draft purposes, and those wanted for food and clothing. The movement of the two groups is shown in Chart 3. In general the curves paral-



lel each other. Comparing the indexes at the two periods we find:

	3-year average (1880, '81, '82) 1890=100.	3-year average (1907, '08, '09) 1890=100.	Increase.
Index for horses, and mules,	76.3	154.6	78.3
Index for cattle, sheep, swine,	78.6	121.6	43.0

Here, it appears, that all food animals increase less rapidly than population. In noting the general movement of farm animals, attention was called to the remarkable drop in production from 1890 to 1900. We are now to observe that the food animals contributed most largely to this long-drawn out slump. It is to be explained by saying that it was a period of low prices, resulting in low production. Only with rising prices was increased production secured, and even at the present high prices, the increase barely equals the increase of population.

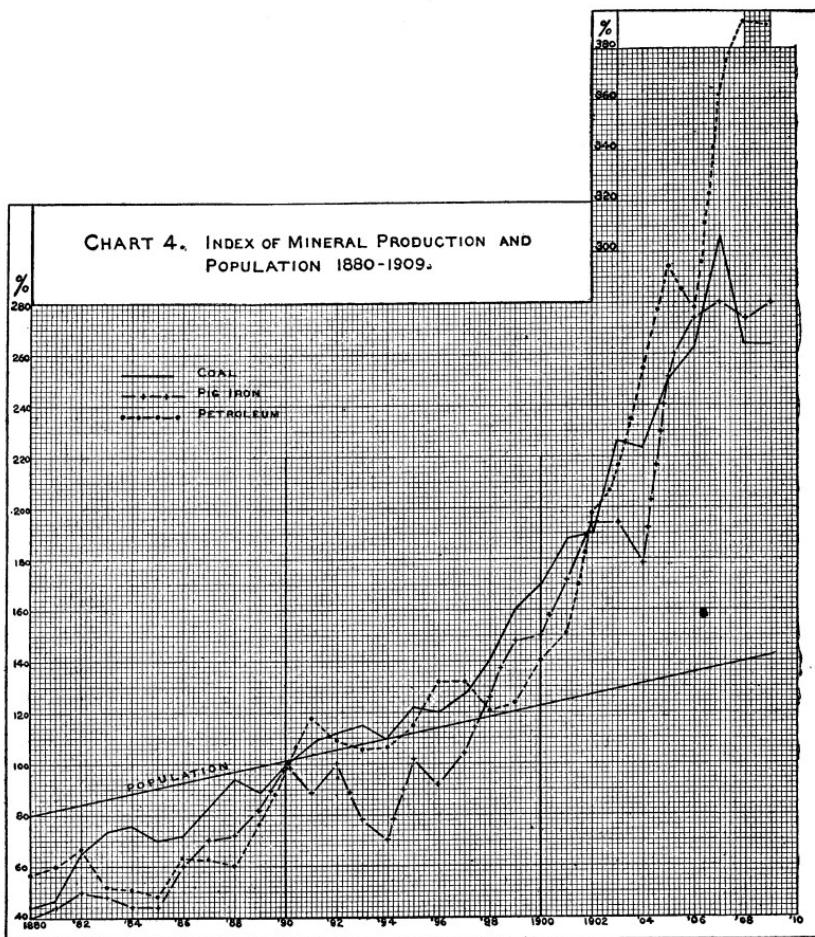
PHENOMENAL INCREASE IN PRODUCTION OF MINERALS.

The radical tendency shown in mineral production, however, is strikingly apparent. (Chart 4). Based upon a comparison between the first and last part of the period the following results are gained.

	3-year average (1880, '81, '82) 1890=100.	3-year average (1907, '08, '09) 1890=100.	Increase.
Index for all Mineral Products,*	53.3	306.3	253.0
" " Lead,	80.7	239.1	158.4
" " Pig Iron,	45.3	244.3	199.0
" " Coal,	51.5	277.0	227.5
" " Zinc,	50.2	337.0	286.8
" " Petroleum,	61.0	388.1	320.1
" " Copper,	28.7	352.0	323.3

* Gold and silver not included.

The two leading characteristics of mineral production have already been noted,—the regularity of the increases, and the rapidity of the increases since 1894. As in agriculture, so also in mining, we find widely differing ratios of increase,



ranging from 158, in the case of lead, to 323 for copper, and 320 for petroleum. Iron and coal hold a midway position between these extremes, increasing in about the same ratios, with fluctuations occurring at closely corresponding periods. In minerals there appear to be fewer fluctuations up and down than in other fields of industry, but when they come they are greater in extent. Of all the minerals, coal is subject to the fewest fluctuations, due to the fact that coal has more than one primary use, and thus demand is more constant.

Compared with agriculture and forestry the output of minerals shows a remarkable development, from which at least two conclusions may reasonably be drawn. The first, already suggested, is that the increase in the production of crude utilities springs pretty largely from mineral sources alone. This is confirmed not only by the facts just given, but by common knowledge as well. In the second place, the rapidity of the increase points clearly in the direction of exploitation of mines and oil fields.

Now in respect to these industries, we are, it is feared, repeating the history connected with agriculture and forestry. Until 1890, we ignorantly supposed that both were inexhaustible, and so we proceeded to use these resources in a most prodigal manner. The sole purpose appeared to be to create vast numbers of farms and to produce from them great quantities of farm products regardless of cost or even prices. In short, we were interested in the creation of farms, not in maintaining them on any strictly business basis. This was none else than the speculative use of lands, which of course, led to the exhaustion of soils. As in the seventies and eighties we were laying waste our forests and mining our agricultural lands, taking no account of exhaustion and depreciation, so now we are mining our mineral resources.

But the consequences of this prodigality will not be the same as in agriculture, or in forestry. In agriculture the soil may be reduced in fertility, but it never becomes entirely exhausted, and there is always the possibility of full restoration. In fact, the pressure of population must eventually reduce agriculture to a cost basis, which of necessity, will include the maintenance of the soil in continuous, or even increasing fertility. The same principle, working through longer periods, applies also to forestry, for the demand for lumber will create a price which must cover its cost of production. In short these industries are not exhaustive of the sources out of which their wealth springs.

In the mining industries, however, it is not possible to reduce the business to a cost basis, since the principle of the sinking fund can be applied to the capital invested, that is to the machinery and plant. For the replacement of the contents

of the mine no replacement fund can be established. Hence, the production of minerals is a purely extractive industry and ultimately exhaustive of the sources out of which its wealth comes.

It is precisely for this reason that the individualistic view point, which in agriculture is not altogether at variance with general welfare, becomes in mining, a question of grave concern. The individual producer of minerals is primarily interested in his capital, and against this he establishes a replacement fund, which becomes a fixed charge upon the industry. Of less interest to him is the slowly shrinking general supply, obtained at increasing costs, which costs are passed on to the consumer. In the remoter fact of exhaustion he is still less concerned. But what to the individual are secondary considerations become matters of primary importance to society, and hence the necessity for a broader view point. Looked at from the social point of view minerals are not merely fixed in quantity; they are becoming increasingly important in the economic life of a people. The import of these unquestioned facts we realize, but seldom ponder.

The social point of view, then, regards mineral deposits as fundamentally essential to the future as well as to our present economic life and urges that their use should be so distributed as to yield, in the long run, the largest aggregate of utilities. This does not mean any penurious hoarding of our mineral treasures for the use of some far-distant time, but it does mean a discriminating frugality in their use, and to this end two policies are advocated by those holding the broader view point. (1) That all unnecessary wastes be eliminated. These are admitted as being enormous in every mining enterprise, and are known to be very largely preventable. To save these wastes is socially desirable even if not expedient to the individual producer. (2) That natural products, which are limited in supply, be more and more restricted to their primary and fundamental uses for which no substitute exists. It is admitted that great difficulty may be found in determining what are primary and what are secondary uses. And yet, it is believed, these may be roughly determined in most instances. To illustrate: Should there be a question as to the use of

petroleum as a dust cover (a secondary use), if, as a base for the manufacture of lubricants (a primary use) there is no equally good substitute? Numerous illustrations of like character, are found in all industries dealing with valuable natural agents.

Those who acquiesce in the prodigal use of the natural agent do so on the basis of two assumptions: The discovery of substitutes, and the application of scientific methods. Both these principles are of undoubted importance. But to place reliance upon a substitute which has not yet appeared and proved its value is the height of social folly. It will be admitted, too, that there are problems which scientific methods cannot solve on any economic basis. Both substitutes and improved processes delay, but do not overthrow that most fundamental of all economic laws, the law of increasing costs.

Finally, the enormous increase in output of utilities over population has given us a new standard of living. To the extent that this rests upon increases from the soil, it is secure and permanent: to the extent that it is based on increased mineral production, and manufacture, it is secure or insecure to the degree that the natural resources are frugally used and carefully husbanded.